Simple and high yielding method for preparing tissue specific extracellular matrix coatings for cell culture.

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Public Summary:
The extracellular matrix is well known to regulate cell growth, survivfal and maturation/differentiation and play an important role in development. Despite teh complex nature of the extracellular matrix found in the body, many studies culture cells on coatings of single purified proteins (such as collagen, fibronectin, or laminin) or directly on plolystyrene (plastic) tissue culture dishes. These surfaces do not mimic the complexity of the extracellular matrix environment in the body and place limitations on translating finding from cell culture to the body. For stem cell research, there is a need to develop coatings that are a closer mimic to that found in the body for matturation of the cells. In many cases, stem cells that have been differentiated into cardiac muscle cells are not fully mature, and have a closer behavior to fetal cardiac muscle cells. Thus we present a simple approach to develop naturally derived matrix coatings for cell culturethat provide important tissue-specific cues from decellularizxed pig tissue. Porcine skeletal muscle and heart tissue were decellularized leaving behind only the extracellular matrix. Then the matrices were digested using an enzyme to make a liqauid form of the matrix that was used for cell coating. After processing, it was found that the matrix retained a complex set of proteins. When muscle progenitor cells and cardiac muscle cells from human embryonic stem cells were cultureed on these complex coatings, both cells types displayed an increase in maturation when compared to standard cell culture coatings. Thus, the tissue-derived matrix coatings can act as a promising platform for cell culture to more closely mimic complex environment seen in the body, and may be better for tranlating studeis from the dish to the body.

Scientific Abstract:
BACKGROUND: The native extracellular matrix (ECM) consists of a highly complex, tissue-specific network of proteins and polysaccharides, which help regulate many cellular functions. Despite the complex nature of the ECM, in vitro cell-based studies traditionally assess cell behavior on single ECM component substrates, which do not adequately mimic the in vivo extracellular milieu. METHODOLOGY/PRINCIPAL FINDINGS: We present a simple approach for developing naturally derived ECM coatings for cell culture that provide important tissue-specific cues unlike traditional cell culture coatings, thereby enabling the maturation of committed C2C12 skeletal myoblast progenitors and human embryonic stem cells differentiated into cardiomyocytes. Here we show that natural muscle-specific coatings can (i) be derived from decellularized, solubilized adult porcine muscle, (ii) contain a complex mixture of ECM components including polysaccharides, (iii) adsorb onto tissue culture plastic and (iv) promote cell maturation of committed muscle progenitor and stem cells. CONCLUSIONS: This versatile method can create tissue-specific ECM coatings, which offer a promising platform for cell culture to more closely mimic the mature in vivo ECM microenvironment.